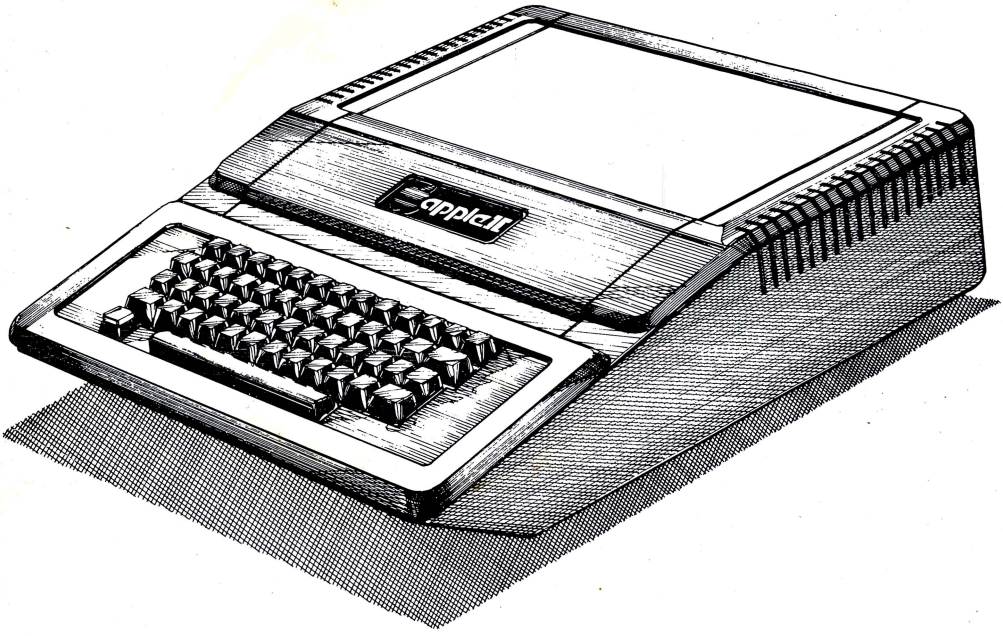
Computer Station's

Programmer's Guide

to the

APPLE II



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All material in this manual was edited from the following Apple manuals:

1. Apple II Reference Manual - Jan. 1978
2. Applesoft II Reference Manual - Aug. 1978
3. Applesoft II Programming Reference Manual

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Preface

This booklet is not meant as a replacement for the three excellent publications of APPLE COMPUTER INC., rather, it is designed as a companion. The information contained in the APPLE publications could not be condensed into one booklet this size. Instead, the command syntax, operands, and special locations have been gleaned from the reference manuals and collected to yield a Programmer's reference. We assume the programmer has already read and absorbed APPLE's publications. This programmer's guide is designed as a helpful tool for speedy information retrival without referring to the entire text found in the APPLE publications.

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System Monitor

System Monitor Commands

Apple II contains powerful machine level monitor for use by the advanced programmer. To enter the monitor either press RESET button on keyboard or CALL -151 (Hex FF65) from Basic. Apple II will respond with an "*" (asterisk) prompt character on the TV display. This action will not kill current BASIC program which may be re-entered by a C^{C} (control C). NOTE: "adrs" is a four digit hexidecimal number. Remember to press "return" button at the end of each line.

Command Format	Example	Description
		Examine Memory
adrs	*CØF2	Examines (displays) single memory location of (adrs).
adrs1.adrs2	*1Ø24.1Ø48	Examines (displays) range of memory from (adrs1) thru (adrs2).
(return)	*(return)	Examines (displays) next 8 memory locations.
.adrs2	*.4Ø96	Examines (displays) memory from current location thru location (adrs2).
		Change Memory
adrs:data data data	*A256:EF 2Ø 43	Deposits data into memory starting at location (adrs).
:data data	*:FØ A2 12	Deposits data into memory starting after (adrs) last used for deposits.
		Move Memory
adrs1<adrs2. adrs3M	*1ØØ<BØ1Ø.B41ØM	Copy the data now in the memory range from (adrs2) to (adrs3) into memory locations starting at (adrs1).
	*8ØØ:Ø 8Ø1<8ØØ.8FEM	Fills from 8ØØ to 8FF with Ø's Note 1: 1 less than last location to be filled. Note 2: Fill byte is hex number immediately after colon (:).
		Verify Memory
adrs1<adrs2. adrs3V	*1ØØ<BØ1Ø.B41ØV	Verify that block of data in memory range from (adrs2) to (adrs3) exactly matches data block starting at memory location (adrs1) and displays differences if any.
		Cassette I/O
adrs1.adrs2R	*3ØØ.4FFR	Reads cassette data into specified memory (adrs) range. Record length must be

		same as memory range or an error will occur.
adrs1.adrs2W	*8ØØ.9FFW	Writes onto cassette, data from specified memory (adrs) range.

Display

I	*I	Set inverse video mode. (Black characters on white background).
N	*N	Set normal video mode. (White characters on black background).

Dis-assembler

adrsL	*C8ØØL	Decodes 2Ø instructions starting at memory (adrs) into 65Ø2 assembly mnenonic code.
L	*L	Decodes next 2Ø instructions starting at current memory address.

Mini-assembler

(Turn-on)	*F666G	Turns-on mini-assembler. Prompt character is now a "!" (exclamation point).
$ (monitor command)	!$C8ØØL	Executes any monitor command from mini-assembler. Note that many monitor commands change current memory address reference so that it is a good practice to retype desired address reference upon return to mini-asembler.
adrs: (65Ø2 MNEMONIC instruction)	!CØ1Ø:STA 23FF	Assembles a mnemonic 65Ø2 instruction into machine codes. If error, machine will refuse instruction, sound bell, and reprint line with up arrow under error.
(space) (65Ø2 mnemonic instruction)	! STA Ø1 FF	Assembles instruction into next available memory location. (Note space between "!" and instruction)
(TURN-OFF)	!(Reset Button)	Exits mini-assembler and returns to system monitor.

Monitor Program Execution and Debugging

adrsG	*3ØØG	Runs machine level program starting at memory (adrs)
adrsT	*8ØØT	Traces a program starting at memory location (adrs) and continues trace until hitting a breakpoint. Break occurs on instruction ØØ (BRK), and returns control to system monitor. Opens 65Ø2 status registers (see Note 1).

adrsS	*CØ5ØS	Single steps through program beginning at memory location (adrs). Type a letter S for each additional step that you want displayed. Opens 65Ø2 status registers (see Note 1).
(Control E)	*E^{C}	Displays 65Ø2 status registers and opens them for modification (see Note 1).
(Control Y)	*Y^{C}	Executes user specified machine language subroutine starting at memory location ($3F8).

Note 1:

65Ø2 status registers are open if they are last line displayed on screen. To change them type ":" then "data" for each register.

Example: A=3C X=FF Y=ØØ P=32 S=F2

*:FF	Changes A register only
*:FF ØØ 33	Changes A, X, and Y registers

To change S register, you must first retype data for A, X, Y and P.

Hexidecimal Arithmetic

data1+data2 *78+34	Performs hexidecimal sum of data1 plus data2.
data1-data2 *AE-34	Performs hexidecimal difference of data1 minus data2.

Set Input/Output Ports

(X) (Control P) *5P^{C}	Sets printer output to I/O slot number (X). (see Note 2 below)
(X) (Control K) *2K^{C}	Sets keyboard input to I/O slot number (X). (see Note 2 below)

Note 2:

Only slots 1 through 7 are addressable in this mode. Address Ø (Ex: ØP^{C} or ØK^{C}) resets ports to internal video display and keyboard. These commands will not work unless Apple II interfaces are plugged into specified I/O slot.

Multiple Commands

*1ØØL 4ØØG AFFT	Multiple monitor commands may be given on same line if separated by a "space".
*LLLL	Single letter commands may be repeated without spaces.

Special Control and Editing Characters

"Control" characters are indicated by a super-scripted "C" such as G^C. They are obtained by holding down the CTRL key while typing the specified letter. Control characters are NOT displayed on the TV screen. B^C and C^C must be followed by a carriage return. Screen editing characters are indicated by a super-scripted "E" such as D^E. They are obtained by pressing and releasing the ESC key then typing specified letter. Edit characters send information only to display screen and does not send data to memory. For example, V^C moves cursor to right and copies text while A^E moves cursor to right but does not copy text.

Character	Description of Action
RESET key	Immediately interrupts any program execution and resets computer. Also sets all text mode with scrolling window at maximum. Control is transferred to System Monitor and Apple prompts with a "*" (asterisk) and a bell. Hitting RESET key does NOT destroy existing BASIC or machine language program.
Control B	If in System Monitor (as indicated by a "*"), a control B and a carriage return will transfer control to BASIC, scratching (killing any existing BASIC program and set HIMEM: to maximum installed user memory and LOMEM: to 2Ø48.
Control C	If in BASIC, halts program and displays line number where stop occurred*. Program may be continued with a CON command. If in System Monitor, (as indicated by "*"), control C and a carriage return will enter BASIC without killing current program.
Control G	Sounds bell (beeps speaker)
Control H	Backspaces cursor and deletes any overwritten characters from computer but not from screen. Apply supplied keyboards have special key "←" on right side of keyboard that provides this function without using control button.
Control J	Issues line feed only.
Control V	Compliment to H^C. Forward spaces cursor and copies over written characters. Apple keyboards have "→" key on right side which also performs this function.
Control X	Immediately deletes current line.
ESC A	Move cursor to right. (does not copy text)
ESC B	Move cursor to left. (does not copy text)
ESC C	Move cursor down. (does not copy text)
ESC D	Move cursor up. (does not copy text)
ESC E	Clear text from cursor to end of line.

ESC F Clear text from cursor to end of page.

ESC @ Home cursor to top of page, clear text to end of page.

*If BASIC program is expecting keyboard input, you will have to hit carriage return key after typing control C.

NOTES:

Calls — Peeks, Pokes & Colors

Hex	BASIC Example	Description
	Graphics Mode Controls	
C0500:0	POKE-16304,0	Set color graphics mode.
C0510:0	POKE-16303,0	Set text mode.
C0520:0	POKE-16302,0	Clear mixed graphics.
C0530:0	POKE-16301,0	Set mixed graphics (4 lines text).
C0540:0	POKE-16300,0	Clear display Page 2 (BASIC commands use Page 1 only)
C0550:0	POKE-16299,0	Set display to Page 2 (alternate).
C0560:0	POKE-16298,0	Clear HIRES graphics mode.
C0570:0	POKE-16297,0	Set HIRES graphics mode.
F836	CALL-1994	Clears upper 20 lines of text page 1 to reversed @ signs. If in low-resolution graphics mode, this clears the upper 40 lines of graphics screen to black (page 1 only).
F832	CALL-1998	Clears entire text page 1 to reversed @ signs. If in page 1 low-resolution graphics mode, this clears the entire screen to black.
F3F2	CALL 62450	Clears current high-resolution screen to black.
F3F6	CALL 62454	Clears current high-resolution screen to HCOLOR most recently HPLOTted. Must by preceded by a plot.
	TEXT Mode Controls	
FC58	CALL-936	(@^{E}) Home cursor, clear screen.
FC42	CALL-958	(F^{E}) Clear from cursor to end of page.
FC9C	CALL-868	(E^{E}) Clear from cursor to end of line.
FC66	CALL-922	(J^{C}) Line feed.
FC70	CALL-912	Scroll up text one line.
0032:3F	POKE 50, 63	Set inverse flag if 63.
0032:FF	POKE 50,255	Set normal flag if 255.
	SCROLLING WINDOW	
0020	POKE 32,L1	Set **LEFT** side of scrolling window to loca - tion specified by L1 in range of 0 to 39.
0021	POKE 33,W1	Set window **WIDTH** to amount specified by W1.L1 + W1 < 40. W1 > 0.
0022	POKE 34,T1	Set window **TOP** to line specified by T1 in range of 0 to 23.
0023	POKE 35,B1	Set window **BOTTOM** to line specified by B1 in range of 0 to 23. B1 > T1.

CURSOR POSITION

ØØ24	CH=PEEK(36) POKE 36,CH TAB(CH+1)	Read/set cursor horizontal position in the range of Ø to 39. If using TAB, you must add "1" to cursor position read value; second and third example perform identical functions.
ØØ25	CV=PEEK(37) POKE 37, CV VTAB(CV+1)	Read/set cursor verticle position in the range of Ø to 23. If using TAB, you must add "1" to cursor position read value; second and third example perform identical functions.

SOUND

CØ3Ø	X=PEEK(-16336)	Toggle speaker. (1 click in speaker)
CØ3Ø:Ø	POKE-16336,Ø	
CØ2Ø	X=PEEK(-16352)	Toggle cassette-output once (1 click on casette recording)

KEYBOARD

CØØØ	X=PEEK(-16384)	Read keyboard; if X>127 then key was pressed. (7F Hex)
CØ1Ø:Ø	POKE-16368,Ø	Clear keyboard stobe - always after reading keyboard.

GAME PADDLES

CØ61	X=PEEK(-16287)	Read PDL (Ø) push button switch. If X>127 then switch is "on." (7F Hex)
CØ62	X=PEEK(-16286)	Read PDL (1) push button switch. If X>127 then switch is "on." (7F Hex)
CØ63	X=PEEK(-16285)	Read PDL (2) push button switch. If X>127 then switch is "on." (7F Hex)
CØ58:1	POKE-16296,1	Clear Game I/O ANØ output. (OFF—3.5V high)
CØ59:Ø	POKE-16295,Ø	Set Game I/O ANØ output. (ON—.3V low)
CØ5A:1	POKE-16294,1	Clear Game I/O AN1 output. (OFF—3.5V high)
CØ5B:Ø	POKE-16293,Ø	Set Game I/O AN1 output. (ON—.3V low)
CØ5C:1	POKE-16292,1	Clear Game I/O AN2 output. (OFF—3.5V high)
CØ5D:Ø	POKE-16291,Ø	Set Game I/O AN2 output. (ON—.3V low)
CØ5E:1	POKE-1629Ø,1	Clear Game I/O AN3 output. (OFF—3.5V high)
CØ5F:Ø	POKE-16289,Ø	Set Game I/O AN3 output. (ON—.3V low)

Colors As Set By Color=

Note: Colors may vary depending on TV tint (hue) setting.

Low-Resolution Colors

Ø = Black
1 = Magenta
2 = Dark Blue
3 = Light Purple
4 = Dark Green
5 = Grey
6 = Medium Blue
7 = Light Blue
8 = Brown
9 = Orange
1Ø = Grey
11 = Pink
12 = Green
13 = Yellow
14 = Blue/Green
15 = White

High-Resolution Colors

Ø = Black 1
1 = Green
2 = Blue
3 = White 1
4 = Black 2
5 = (depends on TV)
6 = (depends on TV)
7 = White 2

NOTES:

High-Resolution Operating Subroutines

(ROM Location shown in parenthesis)
Other locations are for HIRES software.

Hex	BASIC Example	Description
ØCØØ (DØØØ)	CALL 3Ø72 (CALL-12288)	**INIT — Initializes High-Resolution Graphics mode.**

This subroutine sets High-Resolution Graphics mode with a 28Ø x 16Ø matrix of dots in the top portion of the screen and four lines of text in the bottom portion of the screen. INIT also clears the screen.

ØCØE (DØØE)	CALL 3Ø86 (CALL-12274)	**CLEAR — Clears the screen.**

This subroutine clears the High-Resolution screen without resetting the High-Resolution Graphics mode.

ØC7C (DØ7C)	CALL 378Ø (CALL-1158Ø)	**PLOT — Plots a point on the screen.**

This subroutine plots a single point on the screen.

	Plot/Posn Location	Line Location	
Y (vertical) Coordinate	8Ø2 Decimal A - register	8Ø2. Y - register	Range Ø Top of Screen 159 Bottom of Screen
X (horizontal) Coordinate	8ØØ Decimal 8Ø1 Decimal X(X LO) Register Y(Y HI) Register	8ØØ. 8Ø1. A(X LO) X(X HI)	Range Ø (left) to 279 (right) Loc 8ØØ = Xmod 256 8Ø1 = X/256
Color	812 Ø32C Hex		4 Colors Ø ($Ø) Black 85 ($55) Green 17Ø ($AA) Violet 255 ($FF) White

ØC26 (DØ26)	CALL 3761 (CALL-11599)	**POSN — Positions a point on the screen.**

This subroutine does all calculations for a PLOT, but does not plot a point (it leaves the screen unchanged). This is useful when used in conjunction with LINE or SHAPE (described later). To use this subroutine set up the X and Y coordinates just the same as for PLOT. The color in location 812 ($32C) is ignored.

ØC95 (DØ95)	CALL 3786 (CALL-11574)	**LINE — Draw a line on the screen.**

This subroutine draws a line from the last point PLOTed or POSN'ed to the other endpoint which is passed in the same manner as for a PLOT or POSN (8ØØ, 8Ø1, 8Ø2). The color of the line is set in location 812 ($32C). After the line is drawn, the new endpoint becomes the base endpoint for the next line drawn.

ØDBC (D1BC)	CALL 38Ø5 (CALL-11555)	**SHAPE — Draws a predefined shape on the screen.**

This subroutine draws a predefined shape on the screen at the point previously PLOTed or POSN'ed (8ØØ, 8Ø1, 8Ø2). The shape is defined by a table of vectors in memory.

Hex	Decimal	Description
Ø324	8Ø4 (LO)	X mod 256 } Starting Address of Shape
Ø325	8Ø5 (HI)	X/256 } Table
ØØ1C	28	Color of Shape (see plot description)
Ø326	8Ø6	Scaling Factor (1 = same size 2 = twice size, etc.)
Ø327	8Ø7	Rotation Factor Ø to 64 (Ø = right side up 16 = 90° clockwise).

NOTES:

DISK COMMANDS

[ ] indicated not needed, if default values are OK.

See abbreviations and prefixes for definition of single letter abbreviations.

Initialize

INIT f,v[,Ss][,Dd]	Initializes diskette for system of same memory size only - will not boot on system of larger memory size.

General Program Control

LOAD f [,Ss][,Dd][,Vv]	Loads program of name f from disk.
SAVE f [,Ss][,Dd][,Vv]	Saves program of name f to disk.
DELETE f [,Ss][,Dd][,Vv]	Deletes program of name f from disk.
RENAME f,g[,Ss][,Dd][,Vv]	Renames program f to name g
CATALOG [,Ss][,Dd]	Displays the volume number of diskette and list of all files and file types. File types are: I - Integer BASIC program A - Applesoft BASIC program T - Text file - written by WRITE or APPEND commands B - Bit-for-bit image of memory locations (machine code)
VERIFY f[,Ss][,Dd][,Vv]	Performs check on disk data to make sure it is self-consistent — does not check disk against memory contents.
RUN f[,Ss][,Dd][,Vv]	Loads and runs program of name f.
CHAIN f [,Ss][,Dd][,Vv]	For Integer Basic Programs only — loads and runs program f, but does not clear variables from previous program.
EXEC f[,Rr][,Ss][,Dd][,Vv]	Command file for program execution as if entered from keyboard.
LOCK f[,Ss][,Dd][,Vv]	When executed on file f it protects the file from deletion or erasure (write protected).
UNLOCK f[,Ss][,Dd][,Vv]	Removes write protect from file f.

Machine Code

BSAVE f,Aa,Lj [,Ss][,Dd][,Vv]	Saves machine code starting at address a for length j.
BLOAD f[,Aa][,Ss][,Dd][,Vv]	Loads machine code.
BRUN f[,Aa][,Ss][,Dd][,Vv]	Loads and runs machine code.

Files

MAXIFILES n	Specific number of files that are active at one time (1 to 16)
OPEN f[,Lj][,Ss][,Dd][,Vv]	Allocates 600 byte buffer and prepares to write to beginning of file.
CLOSE [f][,Ss][,Dd][,Vv]	Deallocates buffer for file f or all files if f is not specified and closes file indicated or if unspecified, all files.
READ f[,Rr][,Bb][,Ss][,Dd][,Vv]	Causes following input and get statements to obtain data from file f rather than keyboard.
WRITE F[,Rr][,Bb][,Ss][,Dd][,Vv]	Causes following print statements to write to file f.
POSITION f[,Rr][,Ss][,Dd][,Vv]	Positions file pointer to indicated line and byte (relative, not absolute).
APPEND f[,Ss][,Dd][,Vv]	Opens file f and writes data after last data previously written.
NOMON [C][,I][,O]	Prevents writing information specified from being displayed on video screen.
C - disk commands I - information to disk O - output from disk	
MON [C][,I][,O]	Enables commands previously disabled with NOMON.
CTRL/D	Must be used to turn off read command

Control

FP [,Ss][,Dd][,Vv]	Activates Applesoft ROM or loads Applesoft from disk.
INT	Transfers control to Integer Basic.
POKE 72, Ø CALL -151 or CALL -151 48:Ø	Go to monitor.
	NOTE: After using DOS commands in monitor type *48:Ø to insure monitor will work correctly.
3DØG	Go to Basic and preserve program.
3D3G	Returns to Basic losing Basic Program and Applesoft if not in ROM.
CALL 976	Activates DOS is in memory (crashes if not)

ROM/RAM APPLESOFT

To change programs

RAM to ROM (to use APPLESOFT ROM Card)

```
LOAD f
CALL 54514
SAVE f
```

ROM to RAM (no APPLESOFT ROM Card)

```
LOAD f
CALL 3314
SAVE f
```

Abbreviations

f	— File Name 1
g	— File Name 2
s	— Slot Ø to 7
v	— Volume Ø to 254
d	— Drive 1 or 2
r	— Record # Ø to 32767
b	— Byte # Ø to 32767
j	— Length Specifier 1 to 32767
n	— # of Files 1 to 16
a	— Starting Address Decimal $ precedes Hex Numbers
FP	— Applesoft
INT	— Integer Basic

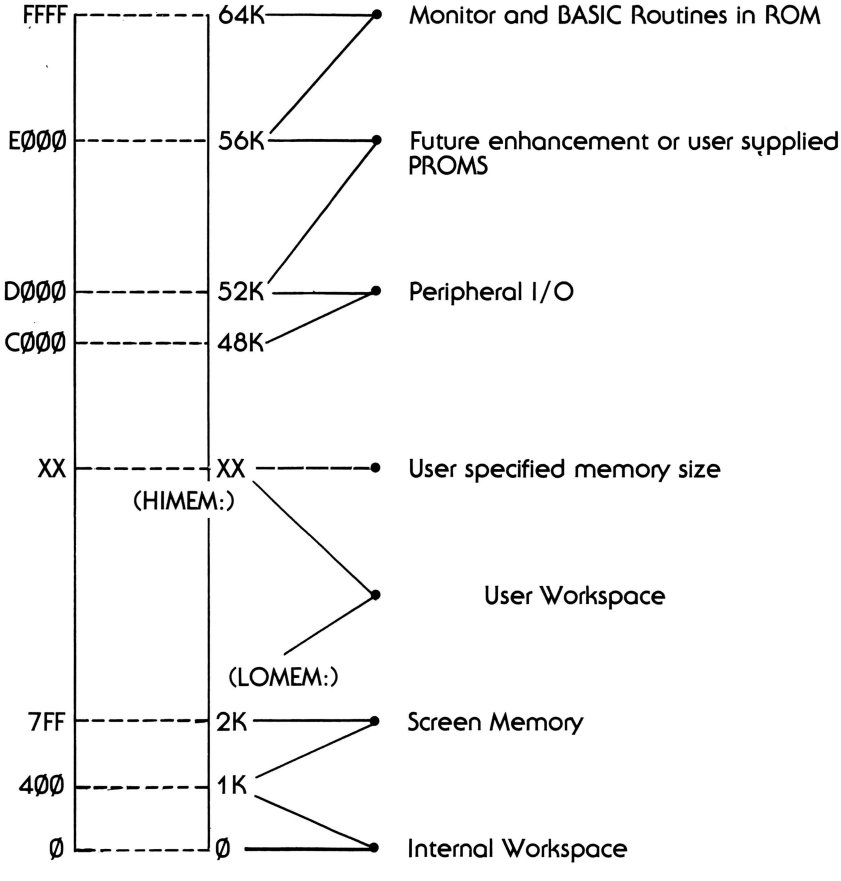
Prefixes

A	— Address Start for Machine Code (decimal)
A$	— Address Start for Machine Code (Hexadecimal)
L	— Record Length (Decimal) Bytes
L$	— Record Length (Hexadecimal) Bytes
V	— Volume
S	— Slot **(Default last booted)**
D	— Drive **(Default last booted)**
R	— Record Number **(Default Ø)**
B	— Byte # **(After r-th CARRIAGE RETURN)**
CTRL D	— Precedes any disk function written in a program
[ ]	— Signifies Optional Specifiers with Prefixes

Memory Map

Memory Range	Description
Ø.1FF	Program work space; not available to user.
2ØØ.2FF	Keyboard character buffer.
3ØØ.3FF	Available to user for short machine language programs.
4ØØ.7FF	Screen display area for page 1 text or color graphics.
8ØØ.2FFF	In cassette tape version, the APPLESOFT BASIC interpreter.
8ØØ.XXX	If firmware APPLESOFT (Part number A2BØØØ9X) installed, user program and variable space, where XXX is maximum RAM memory to be used by APPLESOFT. This is either total system RAM memory, or less if the user is reserving part of high memory for machine language routines or high-resolution screen buffers.
2ØØØ.3FFF	Firmware APPLESOFT only: high-resolution graphics display page 1.
3ØØØ.XXX	Cassette tape APPLESOFT II; user program and variables where XXX is maximum available RAM memory to be used by APPLESOFT. This is either total system RAM memory, or less if the user is reserving part of high memory for machine language routines or page 2 high-resolution graphics.
4ØØØ.5FFF	High-resolution graphics display page 2.
CØØØ.CFFF	Hardware I/O Addresses.
DØØØ.DFFF	Future ROM expansion.
DØØØ.F7FF	APPLESOFT II firmware version, with select switch "ON" (up).
EØØØ.F7FF	APPLE Integer BASIC.
F8ØØ.FFFF	APPLE System Monitor.

Simplified Memory Map



APPLESOFT VARIABLE MAPS

SIMPLE VARIABLES

POINTERS	REAL	INTEGER	STRING POINTERS
$69-$6A	NAME (pos) 1st byte (pos) 2nd byte	NAME (neg) 1st byte (neg) 2nd byte	NAME (neg) 1st byte (pos) 2nd byte
	exponent 1 byte	high byte	length 1 byte
	mantissa m.s. byte	low byte	address low byte
	mantissa	Ø	address high byte
	mantissa	Ø	Ø
	mantissa l.s. byte	Ø	Ø

ARRAY VARIABLES

	REAL	INTEGER	STRING POINTERS
$6B-$6C	NAME (pos) 1st byte (pos) 2nd byte	NAME (neg) 1st byte (neg) 2nd byte	NAME (neg) 1st byte (pos) 2nd byte
	OFFSET pointer to next variable: add to address of this variable name low byte high byte	OFFSET pointer to next variable: add to address of this variable name low byte high byte	OFFSET pointer to next variable: add to address of this variable name low byte high byte
	NO. OF DIMENSIONS one byte	NO. OF DIMENSIONS one byte	NO. OF DIMENSIONS one byte
	SIZE Nth DIMENSION high byte low byte	SIZE Nth DIMENSTION high byte low byte	SIZE Nth DIMENSION high byte low byte
	SIZE 1st DIMENSION high byte low byte	SIZE 1st DIMENSION high byte low byte	SIZE 1st DIMENSION high byte low byte
	REAL (Ø, Ø, . . , Ø) exponent 1 byte mantissa m.s. byte mantissa mantissa mantissa l.s. byte	INTEGER% (Ø, Ø, . . , Ø) high byte low byte	STRING$ (Ø, Ø, . . , Ø) length 1 byte address low byte address high byte
	REAL (N, N, . . , N) exponent 1 byte mantissa m.s. byte mantissa mantissa	INTEGER% (N, N, . . , N) high byte low byte	STRING$ (N, N, . . , N) length 1 byte address low byte address high byte
$6D-$6E	mantissa l.s. byte		

Strings are stored in order of entry, from HIMEM: down. String table points to first character of each string, at the bottom of the string in memory. As strings are changed, new pointing addresses are written; when available memory is used up, house-cleaning deletes all abandoned strings. (House-cleaning is forced by a FRE(X)).

All arrays are stored with the right-most index ascending slowest; e.g., the numbers in the array A• (1, 1) where A• (Ø, Ø)=Ø, A• (1, Ø)=1, A• (Ø, 1)=2, A• (1, 1)=3 would be found in memory in proper sequence.

ASCII CHARACTER CODES

DEC = ASCII decimal code
HEX = ASCII hexadecimal code
CHAR = ASCII character name
n/a = not accessible directly from the APPLE II keyboard
CTRL = depression of control key while striking character indicated.

DEC	HEX	CHAR	WHAT TO TYPE	DEC	HEX	CHAR	WHAT TO TYPE
Ø	ØØ	NULL	CTRL @	48	3Ø	Ø	Ø
1	Ø1	SOH	CTRL A	49	31	1	1
2	Ø2	STX	CTRL B	5Ø	32	2	2
3	Ø3	ETX	CTRL C	51	33	3	3
4	Ø4	ET	CTRL D	52	34	4	4
5	Ø5	ENQ	CTRL E	53	35	5	5
6	Ø6	ACK	CTRL F	54	36	6	6
7	Ø7	BEL	CTRL G	55	37	7	7
8	Ø8	BS	CTRL H or ←	56	38	8	8
9	Ø9	HT	CTRL I	57	39	9	9
1Ø	ØA	LF	CTRL J	58	3A	:	:
11	ØB	VT	CTRL K	59	3B	;	;
12	ØC	FF	CTRL L	6Ø	3C	<	<
13	ØD	CR	CTRL M or RETURN	61	3D	=	=
14	ØE	SO	CTRL N	62	3E	>	>
15	ØF	SI	CTRL O	63	3F	?	?
16	1Ø	DLE	CTRL P	64	4Ø	@	@
17	11	DC1	CTRL Q	65	41	A	A
18	12	DC2	CTRL R	66	42	B	B
19	13	DC3	CTRL S	67	43	C	C
2Ø	14	DC4	CTRL T	68	44	D	D
21	15	NAK	CTRL U or →	69	45	E	E
22	16	SYN	CTRL V	7Ø	46	F	F
23	17	ETB	CTRL W	71	47	G	G
24	18	CAN	CTRL X	72	48	H	H
25	19	EM	CTRL Y	73	49	I	I
26	1A	SUB	CTRL Z	74	4A	J	J
27	1B	ESCAPE	ESC	75	4B	K	K
28	1C	FS	n/a	76	4C	L	L
29	1D	GS	CTRL shift-M	77	4D	M	M
3Ø	1E	RS	CTRL ^	78	4E	N	N
31	1F	US	n/a	79	4F	O	O
32	2Ø	SPACE	space	8Ø	5Ø	P	P
33	21	!	!	81	51	Q	Q
34	22	"	"	82	52	R	R
35	23	#	#	83	53	S	S
36	24	$	$	84	54	T	T
37	25	%	%	85	55	U	U
38	26	&	&	86	56	V	V
39	27	'	'	87	57	W	W
4Ø	28	(	(	88	58	X	X
41	29	)	)	89	59	Y	Y
42	2A	*	*	9Ø	5A	Z	Z
43	2B	+	+	91	5B	[	n/a
44	2C	,	,	92	5C	\	n/a
45	2D	—	—	93	5D	]	] (shift-M)
46	2E	.	.	94	5E	^	^
47	2F	/	/	95	5F	_	n/a

Decimal Tokens for Keywords

XDRAW not currently used in Applesoft commands

Hex	Decimal Token	Keyword	Hex	Decimal Token	Keyword
8Ø	128	END	AA	17Ø	LET
81	129	FOR	AB	171	GOTO
82	13Ø	NEXT	AC	172	RUN
83	131	DATA	AD	173	IF
84	132	INPUT	AE	174	RESTORE
85	133	DEL	AF	175	&
86	134	DIM	BØ	176	GOSUB
87	135	READ	B1	177	RETURN
88	136	GR	B2	178	REM
89	137	TEXT	B3	179	STOP
8A	138	PR#	B4	18Ø	ON
8B	139	IN#	B5	181	WAIT
8C	14Ø	CALL	B6	182	LOAD
8D	141	PLOT	B7	183	SAVE
8E	142	HLIN	B8	184	DEF
8F	143	VLIN	B9	185	POKE
9Ø	144	HGR 2	BA	186	PRINT
91	145	HGR	BB	187	CONT
92	146	HCOLOR=	BC	188	LIST
93	147	HPLOT	BD	189	CLEAR
94	148	DRAW	BE	19Ø	GET
95	149	XDRAW - (n/a)	BF	191	NEW
96	15Ø	HTAB	CØ	192	TAB(
97	151	HOME	C1	193	TO
98	152	ROT=	C2	194	FN
99	153	SCALE=	C3	195	SPC(
9A	154	SHLOAD	C4	196	THEN
9B	155	TRACE	C5	197	AT
9C	156	NOTRACE	C6	198	NOT
9D	157	NORMAL	C7	199	STEP
9E	158	INVERSE	C8	2ØØ	+
9F	159	FLASH	C9	2Ø1	—
AØ	16Ø	COLOR=	CA	2Ø2	*
A1	161	POP	CB	2Ø3	/
A2	162	VTAB	CC	2Ø4	^
A3	163	HIMEN:	CD	2Ø5	AND
A4	164	LOMEN:	CE	2Ø6	OR
A5	165	ONERR	CF	2Ø7	>
A6	166	RESUME	DØ	2Ø8	=
A7	167	RECALL	D1	2Ø9	<
A8	168	STORE	D2	21Ø	SGN
A9	169	SPEED=	D3	211	INT

Hex	Decimal Token	Keyword
D4	212	ABS
D5	213	USR
D6	214	FRE
D7	215	SCRN(
D8	216	PDL
D9	217	POS
DA	218	SQR
DB	219	RND
DC	22Ø	LOG
DD	221	EXP
DE	222	COS
DF	223	SIN
EØ	224	TAN
E1	225	ATN
E2	226	PEEK
E3	227	LEN
E4	228	STR$
E5	229	VAL
E6	23Ø	ASC
E7	231	CHR$
E8	232	LEFT$
E9	233	RIGHT$
EA	234	MID$

NOTES:

ERROR CODES

Error detected if PEEK(216) 127
POKE 216,Ø — resets ERRFLG
Y=PEEK(212) — Y is error code returned in decimal

COMMANDS RELATED TO ERRORS

34Ø X = PEEK (218) + PEEK (219) * 256

This statement sets X equal to the line number of the statement where an error occurred if an ONNERGOTO statement has been executed.

Hex	Decimal Value	Error Type Encountered
Ø	Ø	NEXT without FOR
1Ø	16	Syntax
16	22	RETURN without GOSUB
2A	42	Out of DATA
35	53	Illegal Quantity
45	69	Overflow
4Ø	77	Out of Memory
5A	9Ø	Undefined Statement
6B	1Ø7	Bad Subscript
78	12Ø	Redimensioned Array
85	133	Division by Zero
A3	163	Type Mismatch
BØ	176	String Too Long
BF	191	Formula Too Complex
EØ	224	Undefined Function
FE	254	Bad Response to an INPUT Statement
FF	255	Ctrl C Interrupt Attempted

POKE 768, 1Ø4 : POKE 769, 168 : POKE 77Ø, 1Ø4 : POKE 771, 166:
POKE 772, 223 : POKE 773, 154 : POKE 774, 72 : POKE 775, 1'52 :
POKE 776, 72 : POKE 777, 96

Establishes a machine-language subroutine at location 768, which can be used in an error-handling routine. Clears up some ONERR GOTO problems with PRINT and ?OUT OF MEMORY ERROR messages. Use the command CALL 768 in the error-handling routine.

DISK ERROR MESSAGES

Error Code At Decimal 222 (Hex DE)

Hex	Decimal Value	Error Messages
Ø4	4	Write Protect
Ø5	5	End of Data
Ø6	6	File Not Found
Ø7	7	Volume Mismatch
Ø8	8	DISK I/O
Ø9	9	Disk Full
ØA	1Ø	File Locked
ØB	11	CMD Syntax
ØC	12	No File Buffs Available
ØD	13	Not Basic Program
ØE	14	Program Too Large
ØF	15	Not Binary File Error

NOTES:

Applesoft Zero Page Usage

Location(s) (in hex)	Use
$Ø-$5	Jump instructions to continue in APPLESOFT. (reset ØG return for APPLESOFT is equivalent to reset ctrl C return for Integer BASIC.)
$A-$C	Location for USR function's jump instruction.
$D-$17	General purpose counters/flags for APPLESOFT.
$2Ø-$4F	APPLE II system monitor reserved locations.
$5Ø-$61	General purpose pointers for APPLESOFT.
$62-$66	Result of last multiply/divide.
$67-$68	Pointer to beginnig of program. Normally set to $Ø8Ø1 for ROM version, or $3ØØ1 for RAM (cassette tape) version.
$69-$6A	Pointer to start of simple variable space. Also points to the end of the program plus 1 or 2, unless changed with the LOMEM: statement.
$6B-$6A	Pointer to beginning of array space.
$6D-$6E	Pointer to end of numeric storage in use.
$6F-$7Ø	Pointer to start of string storage. Strings are stored from here to the end of memory.
$71-$72	General pointer.
$73-$74	Highest location in memory available to APPLESOFT plus one. Upon initial entry to APPLESOFT, is set to the highest RAM memory location available.
$75-$76	Current line number of line being executed.
$77-$78	"Old line number". Set up by a ctrl C, STOP or END statement. Gives line number at which execution was interrupted.
$79-$7A	"Old text pointer". Points to location in memory for statement to be executed next.
$7B-$7C	Current line number from which DATA is being READ.
$7D-$7E	Points to absolute location in memory from which DATA is being READ.
$7F-$8Ø	Pointer to current source of INPUT. Set to $2Ø1 during an INPUT statement. During a READ statement is set to the DATA in the program it is READing from.
$81-$82	Holds the last-used variable's name.
$83-$84	Pointer to the last-used variable's value.
$85-$9C	General usage.
$9D-$A3	Main floating point accumulator.
$A4	General use in floating point math routines.
$A5-$AB	Secondary floating point accumulator.

$AC-$AE	General usage flags/pointers.
$AF-BØ	Pointer to end of program (**not** changed by LOMEM:)
$B1-$C8	CHRGET routine. APPLESOFT calls here everytime it wants another character.
$B8-$B9	Pointer to last character obtained through the CHRGET routine.
$C9-$CD	Random number.
$DØ-$D5	High-resolution graphics scratch pointers.
$D8-$DF	ONERR pointers/scratch.
$EØ-$E2	High-resolution graphics X and Y coordinates.
$E4	High-resolution graphics color byte.
$E5-$E7	General use for high-resolution graphics.
$E8-$E9	Pointer to beginning of shape table.
$EA	Collision counter for high-resolution graphics.
$FØ-$F3	General use flags.
$F4-$F8	ONERR pointers.

NOTES:

Reserved Words in Applesoft & Integer Basic

[1] Integer Basic Only

[2] Applesoft Basic Only

&[2]							
ABS[1]	AND[2]	ASC[1]	AT[1]	ATN[1]	AUTO[1]		
CALL[1]	CHR$[2]	CLEAR[2]	CLR[1]	COLOR [1]	CON[1]	CONT[2]	COS[1]
DATA[2]	DEF[2]	DEL[1]	DIM[1]	DRAW[2]	DSP[1]		
END[1]	EXP[2]						
FLASH[2]	FN[2]	FOR[1]	FRE[2]				
GET[2]	GOSUB[1]	GOTO[1]	GR[1]				
HCOLOR[2]	HGR[2]	HGR2[2]	HIMEM:[1]	HLIN[1]	HOME[2]	HPLOT[2]	HTAB[2]
IF[1]	IN#[1]	INPUT[1]	INT[2]	INVERSE[2]			
LEFT$[2]	LEN[1]	LET[1]	LIST[1]	LOAD[1]	LOG[1]	LOMEM:[1]	
MID$[2]	MAN[1]						
NEW[1]	NEXT[1]	NORMAL[2]	NOT[2]	NOTRACE[1]	NO DSP[1]		
ON[2]	ONERR[2]	OR[2]					
PDL[1]	PEEK[1]	PLOT[1]	POKE[1]	POP[1]	POS[2]	PRINT[1]	PR#[1]
READ[2]	RECALL[2]	REM[1]	RESTORE[2]	RESUME[2]	RETURN[1]	RIGHT$[2]	
RND[1]	ROT=[2]	RUN[1]					
SAVE[1]	SCALE=[2]	SCRN([1]	SGN[1]	SHLOAD[2]	SIN[1]	SPC([1]	
	SPEED=[2]	SQR[2]	STEP[1]	STOP[2]	STORE[2]	STR$[2]	
TAB([1]	TAN[2]	TEXT[1]	THEN[1]	TO[1]	TRACE[1]		
USR[2]							
VAL[2]	VLIN[1]	VTAB[1]					
WAIT[2]							
XPLOT[2]	XDRAW[2]						

APPLESOFT "tokenizes" these reserved words: each word takes up only one byte of program storage. All other characters in program storage use up only one byte of program storage each.

NOTE

The ampersand (&) is intended for the computer's internal use only; it is **not** a proper APPLESOFT command. This symbol, when executed as an instruction, causes an unconditional jump to location $3F5. Use reset ctrl C return to recover.

XPLOT is a reserved word that does not correspond to a current APPLESOFT command.

See next page for special cases of reserved words.

Reserved words recognized by APPLESOFT only in certain contexts.

COLOR, HCOLOR, SCALE, SPEED, and ROT
parse as reserved words only if the next non-space character is the replacement sign, = . This is of little benefit in the case of COLOR and HCOLOR, as the included reserved word OR prevents their use in variable names anyway.

SCRN, SPC and TAB
parse as reserved words only if the next non-space character is a left parenthesis, (.

HIMEM:
must have its colon (:) to be parsed as a reserved word.

LOMEM:
also requires a colon (:) if it is to be parsed as a reserved word.

ATN
is parsed as reserved word only if there is no space between the T and the N. If a space occurs between the T and the N, the reserved word AT is parsed, instead of ATN.

TO
is parsed as a reserved word **unless** preceded by an A **and** there is a space betweenthe T and the O. If a space occurs between the T and the O, the reserved word AT is parsed instead of TO.

Sometimes parentheses can be used to get around reserved words:

```
                100 FOR A = LOFT OR CAT TO 15
LISTs as        100 FOR A = LOF TO RC AT TO 15
but             100 FOR A = (LOFT) OR (CAT) TO 15
LISTs as        100 FOR A = (LOFT) OR (C  AT  ) TO 15
```

NOTES:

APPLESOFT ROM CARD

Applesoft/Integer Movement

[RESET] CØ8Ø [RETURN] CTRL/B [RETURN]	To initialize APPLESOFT.
[RESET] CØ81 [RETURN] CTRL/B [RETURN]	To initialize Integer Basic.

ALGEBRAIC OPERATORS

=	Assigns value to variable (LET optional)
—	Negation
^	Exponentiation
*	Multiplication
/	Division
+	Addition
—	Subtraction

RELATIONAL AND LOGICAL OPERATORS

=	Equal
<>	Not equal
<	Less than
>	Greater than
<=	Less than or equal
>=	Greater than or equal

NOT	Logical "Not"
AND	Logical "And"
OR	Logical "Or"

Relational and logical expresions have value 1 if true, Ø is false. Relational operators can also be used to compare strings.

NOTES:

SYSTEM AND UTILITY COMMANDS

Keyword	Definition
LOAD	Loads a program from tape.
LOAD f	Loads a program f from disk.
SAVE	Saves a program on tape.
SAVE f	Saves a program f to disk.
NEW	Deletes current program.
RUN	Executes program starting at lowest line number.
RUN 477	Executes program starting at line 477.
RUN f	Loads and runs a program f from disk.
STOP	Halts execution and tells in which line.
END	Halts execution with no message.
CTRL C	Used in immediate mode to halt program or listing.
(reset)	Unconditional jump to Monitor. Use ctrl C or ØG to return to APPLESOFT. If in DOS use 3DØG.
CONT	Continues program execution stopped by STOP, END or ctrl C.
TRACE	Debugging aid; lists each line number as it is executed.
NOTRACE	Turns off TRACE.
PEEK(X)	Returns contents of memory location X.
POKE X,13	Changes contents of memory location X to the value 13.
WAIT X,Y,Z	Waits until contents of location X, when XORed with Z and ANDed with Y, gives non-zero result.
CALL X	Goes to machine-language subroutine beginning at memory location X.
USR (X)	Passes value X to a machine-language subroutine.
HIMEM:	Sets highest memory address available to APPLESOFT program use.
LOMEM:	Sets lowest memory address available to APPLESOFT program use. (Cannot be changed without destroying variables.)

EDITING AND FORMAT-RELATED COMMANDS

LIST	Lists entire program.
LIST X-Y	Lists from line X to line Y.
DEL X,Y	Deletes from line X to line Y.
REM	For writing program comments; ignored by program.
VTAB Y	Moves cursor to line Y (1 to 24). - Vertical Position
HTAB X	Moves cursor to position X (1 to 4Ø). - Horizontal Position
TAB(X)	Used only with PRINT statement; moves cursor to position X (1 to 4Ø).
POS(Ø)	Returns current horizontal position of cursor (Ø to 39).
SPC(X)	Used only with PRINT statement; puts X spaces between last item printed and next.
HOME	Clears screen and puts cursor at top left corner.
CLEAR	Resets all variables to zero.

FRE(Ø)	Returns amount of memory still available to user.
FLASH	Sets computer output to flashing.
INVERSE	Sets computer output to black on white. (reversed)
NORMAL	Turns off flashing or inverse output.
SPEED=X	Sets character output rate (Ø to 255).
ESC A	Moves cursor one space right. (does not copy text)
ESC B	Moves cursor one space left. (does not copy text)
ESC C	Moves cursor one space down. (does not copy text)
ESC D	Moves cursor one space up. (does not copy text)
right-arrow	Enters character under cursor into memory, and moves cursor one space right.
left-arrow	Deletes one character from line being typed, and moves cursor one space left. (also CTRL H)
CTRL X	Cancels line currently being typed.

ARRAYS AND STRINGS

DIM A(X,Y,Z)	Sets maximum subscripts for A; reserves memory space for X+1 * Y+1 * Z+1 real elements, starting with A(Ø,Ø,Ø).
DIM A$(X,Y)	Sets maximum subscripts for A$, which may contain X+1 *Y+1 strings elements, each of up to 255 characters.
LEN(A$)	Returns number of characters in A$.
STR$(X)	Returns numeric value of X, converted to a string.
VAL(A$)	Returns A$, up to the first non-numeric character, as a numeric value.
CHR$(X)	Returns ASCII character whose code is X.
ASC(A$)	Returns ASCII code for first character of A$.
LEFT$(A$,X)	Returns leftmost X characters of A$.
RIGHT$(A$,X)	Returns rightmost X characters of A$.
MID$(A$,X,Y)	Returns Y characters of A$, starting at character X.
+	Operator used to concatenate strings.
STORE A	Saves numeric array A on tape. Cannot be used to save string arrays, directly.
RECALL B	Loads array back from tape; array B must have been DIMensioned correctly.

INPUT/OUTPUT COMMANDS

(Also see LOAD and SAVE, STORE and RECALL.)

INPUT A$	Puts ? on screen; waits for user to type a string value for A$. (also used to input data from disk - see Disc Commands section)
INPUT "XYZ";A	Prints XYZ on screen; waits for user to type a real number value for A.
GET A$	Waits for user to type a one-character value for A$; does not need RETURN key. (also used to input data from disk - see Disk Commands section)

DATA X,"Y",Z	Establishes list of data elements that can be used by READ statements. (X and Z represent numeric variables, Y represents literal value)
READ A$	Assigns next DATA element to A$. (also used before input and get commands for disk operations)
RESTORE	Resets data pointer to first element of first data statement. Read statement will now begin with first data element.
PRINT "X= ";X	Prints string X= and value of variable X on screen. Semicolons concatenate printed items, commas separate items into three tab fields. The symbol ? also means PRINT. (there are no leading or following spaces for numbers, these must be added in programming)
IN#6	Takes future input from peripheral device in slot#6, instead of from keyboard (IN#Ø).
PR#6	Sends output to peripheral device in slot#6, instead of to TV screen (PR#Ø).
LET X=Y	LET is optional; assigns value of Y to variable X.
DEF FN A(X)= X+25/X	Defines a function FNA. In later use, the argument of FNA will be substituted for X in the defined expression. FNA(4) would return 9.75.

NOTES:

COMMANDS RELATING TO FLOW OF CONTROL

GOTO 347	Branches to line 347.
IF X=3 THEN STOP	If the assertion X=3 is true (non-zero), then execution continues. If the assertion is false (zero), then execution jumps to the next numbered line.
FOR X=1 TO 2Ø STEP 4: NEXT X	Executes all statements between the FOR statement and the corresponding NEXT, first with X=1, then with X=5, X=9, etc. until X>2Ø, when execution continues after NEXT. STEP size is 1 if not specified.
NEXT X	Defines bottom of FOR . . . NEXT loop. The X is optional.
GOSUB 33	Branches to the subroutine at line 33.
RETURN	Marks end of subroutine; returns to statement following most recent GOSUB. (used if there is no return for a GOSUB
POP	Removes one address from RETURN the address stack.
ON X GOTO 397, 12, 458	Branches to the Xth line number in the list. If X=2, goes to line 12.
ON X GOSUB 397, 12, 458	Branches to subroutine at the Xth line number in the list.
ONERR GOTO 45ØØ RESUME	Subsequent errors cause branch to error-handling routine at line 45ØØ instead of message and program halt.
RESUME	In error-handling routine, causes return to statement where error occurred.

GRAPHICS AND GAME CONTROLS

Low-Resolution Graphics

GR	Sets low-resolution graphics; clears top 4Ø x 4Ø area to black; bottom 4 lines text.
COLOR=X	Sets color (Ø to 15) for next plotting. (see section for colors)
PLOT X,Y	Places colored dot at horizontal coordinate X and vertical coordinate Y. X and Y are from Ø to 39. Ø,Ø is top left.
LIN X1,Y2 AT Y	Draws horizontal line from the point at X1,Y to the point at X2,Y.
VLIN Y1,Y2 AT X	Draws vertical line from the point at X,Y1 to the point at X,Y2.
SCRN(X,Y)	Returns color on screen at the point X,Y. (X=horizontal Y=vertical)

High-Resolution Graphics

HGR	Sets high-resolution graphics, page 1; clears top 28Ø x 16Ø area to black; bottom 4 lines text.
HGR 2	Sets high-resolution graphics, page 2; clears entire 28Ø x 192 screen to black.
HCOLOR=X	Sets color (Ø to 7) for next plotting. (see section for colors)
HPLOT X,Y	Places colored dot at horizontal coordinate X and vertical coordinate Y. X is from Ø to 279; Y is from Ø to 159 (HGR) or to 191 (HGR2). Ø,Ø is top left corner.
HPLOT X1,Y1	Draws line from the point at X1,Y1 to the point at X2,Y2. Com-
TO X2,Y2	mand may be extended to additional points . . .TO XN, YN.
SHLOAD	Loads a shape table from tape. (loads just below HIMEM: and HIMEM: is changed to just below shape table)
DRAW 3 AT X,Y	Draws shape definition #3 from a previously loaded shape table, starting at the point X,Y in color set by HCOLOR.
XDRAW 3 AT X,Y	Draws shape definition #3 from shape table; color of each point plotted is complement of color on screen at that point.
ROT=X	Sets rotation of shape for DRAW or XDRAW. ROT=Ø is vertical, ROT=16 is 9Ø degrees clockwise, ROT=32 is 18Ø degrees clockwise, etc. (if SCALE=1 only 4 90° rotations are possible)
SCALE=X	SEts scale (1 to 255) of shape for DRAW or XDRAW.

Game Controls

PDL (X)	Returns setting from Ø to 255 of game control X (Ø to 3).
PEEK(X-16287)	If >127, button on game control X (Ø to 2) is being pressed.
PEEK(-16336)	"Clicks" APPLE's speaker. (1 click each PEEK)

NOTES:

SOME MATH FUNCTIONS

SIN(X)	Returns sine of X radians.
COS(X)	Returns cosine of X radians.
TAN(X)	Returns tangent of X radians.
ATN(X)	Returns arctangent, in radians, of X.
INT(X)	Returns largest integer less than or equal to X.
RND(1)	Returns random real number from Ø to Ø.999999999 each time used.
RND(Ø)	Returns last random number again.
RND(-3)	Returns 4.48217179E-Ø8. A different fixed number is returned for each different negative argument. After this, RND with positive argument will follow a fixed sequence.
SGN(X)	Returns -1 if X< Ø, Ø if X=Ø, and 1 if X> Ø.
ABS(X)	Returns absolute value of X.
SQR(X)	Returns positive square root of X.
EXP(X)	Returns e (2.718289) to the power X.
LOG(X)	Returns natural logarithm of X.

NOTES:

Command Subroutines in the Cassette Version of APPLESOFT II

COMMAND WORD	ADDRESS OF ASCII STRING	ADDRESS OF POINTER TO SUBROUTINE	ADDRESS OF SUBROUTINE	COMMAND WORD	ADDRESS OF ASCII STRING	ADDRESS OF POINTER TO SUBROUTINE	ADDRESS OF SUBROUTINE
END	8DØ	8ØØ	1Ø72	LOAD	9BB	86C	1ØCB
FOR	8D3	8Ø2	F68	SAVE	9BF	86E	1ØB2
NEXT	8D6	8Ø4	14FC	DEF	9C3	87Ø	1BØC
DATA	8DA	8Ø6	1197	POKE	9C6	872	1F72
INPUT	8DE	8Ø8	13B5	PRINT	9CA	874	12D7
DEL	8E3	8ØA	2B38	CONT	9CF	876	1Ø98
DIM	8E6	8ØC	17DC	LIST	9D3	878	EA7
READ	8E9	8ØE	13E5	CLEAR	9D7	87A	E6A
GR	8ED	81Ø	2B8C	GET	9DC	87C	13A3
TEXT	8EF	812	2B95	NEW	9DF	87E	E49
PR#	8F3	814	29EC	TAB(	9E2		
IN#	8F6	816	29E5	TO	9E6		
CALL	8F9	818	29DC	FN	9E8		
PLOT	8FD	81A	2A2C	SPC(	9EA		
HLIN	9Ø1	81C	2A39	THEN	9EE		
VLIN	9Ø5	81E	2A48	AT	9F2		
HGR2	9Ø9	82Ø	2BD4	NOT	9F4		
HGR	9ØD	822	2BDE	STEP	9F7		
HCOLOR	91Ø	824	2EE5	+	9FB	8B2	1FB8
HPLOT	916	826	2EFA	–	9FC	8B5	1FA1
DRAW	91B	828	2F62	*	9FD	8B8	2179
XDRAW	91F	82A	2F68	/	9FE	8BB	226Ø
HTAB	924	82C	2FEØ	^	9FF	8BE	268E
HOME	928	82E	FC58	AND	AØØ	8C1	1758
ROT	92C	83Ø	2F1A	OR	AØ3	8C4	1752
SCALE	93Ø	832	2F2Ø	>	AØ5	8C7	26C7
SHLOAD	936	834	2F6E	=	AØ6	8CA	169B
TRACE	93C	836	2A74	<	AØ7	8CD	1768
NOTRACE	941	838	2A76	SGN	AØ8	88Ø	2387
NORMAL	948	83A	2A7A	INT	AØB	882	241A
INVERSE	94E	83C	2A7E	ABS	AØE	884	23A6
FLASH	955	83E	2A87	USR	A11	886	ØØØA
COLOR=	95A	84Ø	2A56	FRE	A14	888	1AD7
POP	96Ø	842	116D	SCRN	A17	88A	C12
VTAB	963	844	2A5D	PDL	A1C	88C	17DØ
HIMEM:	967	846	2A8D	POS	A1F	88E	1AF8
LOMEM:	96D	848	2AAD	SQR	A22	89Ø	2684
ONERR	973	84A	2AD2	RND	A25	892	27A5
RESUME	978	84C	2B1F	LOG	A28	894	2138
RECALL	97E	84E	2BB8	EXP	A2B	896	27ØØ
STORE	984	850	2B9B	COS	A2E	898	27E1
SPEED=	989	852	2A69	SIN	A31	89A	27E8
LET	98F	854	1248	TAN	A34	89C	2831
GOTO	992	856	1140	ATAN	A37	89E	2895
RUN	996	858	1114	PEEK	A3A	8AØ	1F5B
IF	999	85A	11CB	LEN	A3E	8A2	1ECD
RESTORE	99B	85C	104B	STR$	A41	8A4	1BBE
&	9A2	85E	8ØØ-see note	VAL	A45	8A6	1EFE
GOSUB	9A3	86Ø	1123	ASC	A48	8A8	1EDC
RETURN	9A8	862	116D	CHR$	A4B	8AA	1E3D
REM	9AE	864	11DE	LEFT$	A4F	8AC	1E51
STOP	9B1	866	1Ø7Ø	RIGHT$	A54	8AE	1E7D
ON	9B5	868	11EE	MID$	A5A	8BØ	1E88
WAIT	9B7	86A	1F7B				

NOTE: The $ command is apparently there for later expansion and if you use it now your program will bomb!

USER NOTES:

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CMST-K1665

$4.95